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(54) **METHOD OF HAND-OVER IN THE MIXED NETWORK OF ASYNCHRONOUS COMMUNICATION NETWORK AND SYNCHRONOUS COMMUNICATION NETWORK**

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(57) **ABSTRACT**

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In the present invention, as a mobile communication terminal, which is using service in the area of an asynchronous mobile communication system, detects signals from a synchronous mobile communication system, the mobile communication terminal repeatedly performs a process of examining whether, in a predetermined time, signals from the asynchronous mobile communication system have been detected a designated number of times, and measuring the intensity of the signals. When the number of times that the intensity of signals from the asynchronous mobile communication system is smaller than a designated number of times, or no signals from the asynchronous mobile communication system are detected, within the predetermined time, it is determined whether to perform handover of the mobile communication terminal.

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H04M 1/00 (2006.01)

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See application file for complete search history.

6 Claims, 3 Drawing Sheets

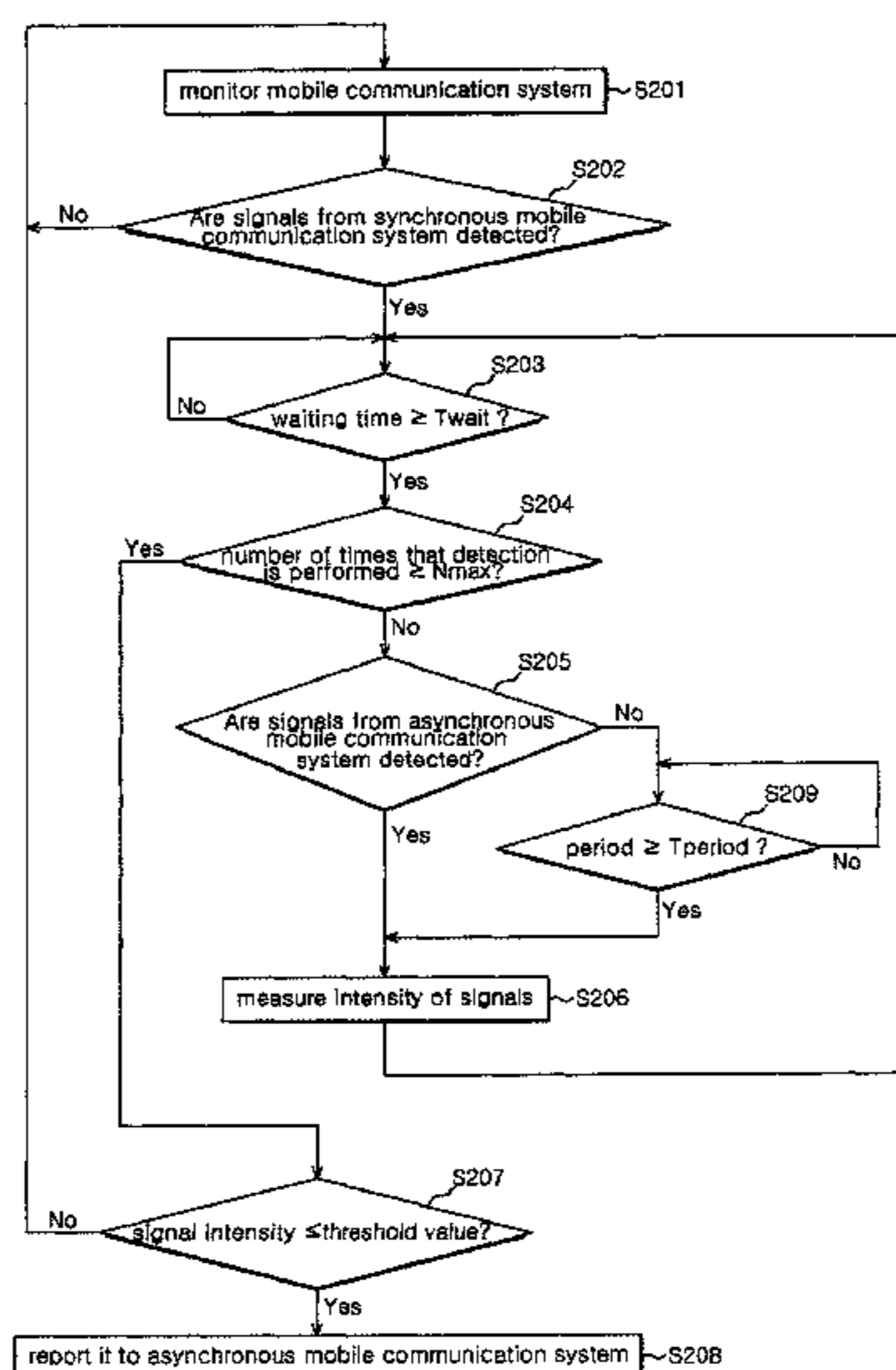


FIG.1

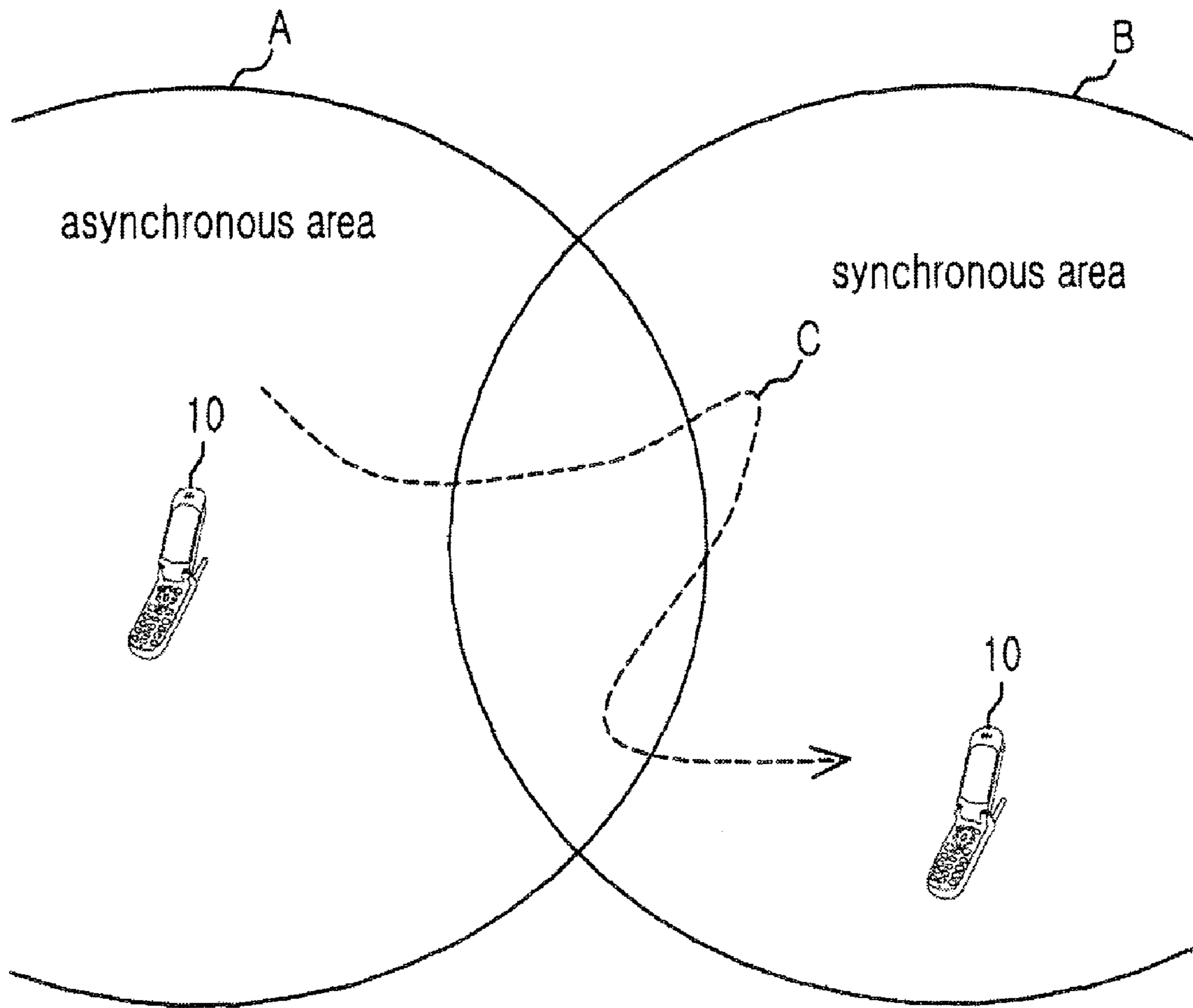


FIG.2

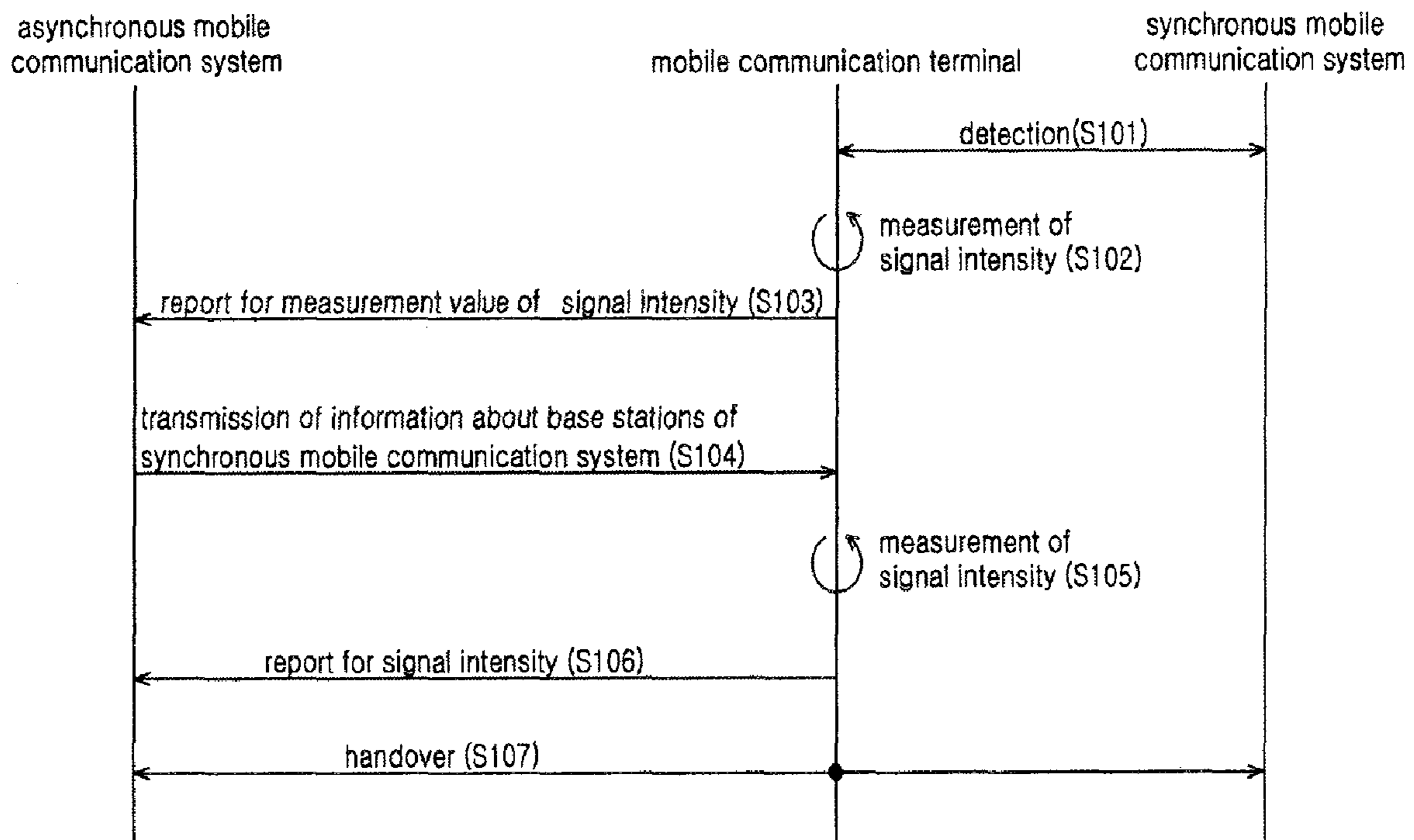
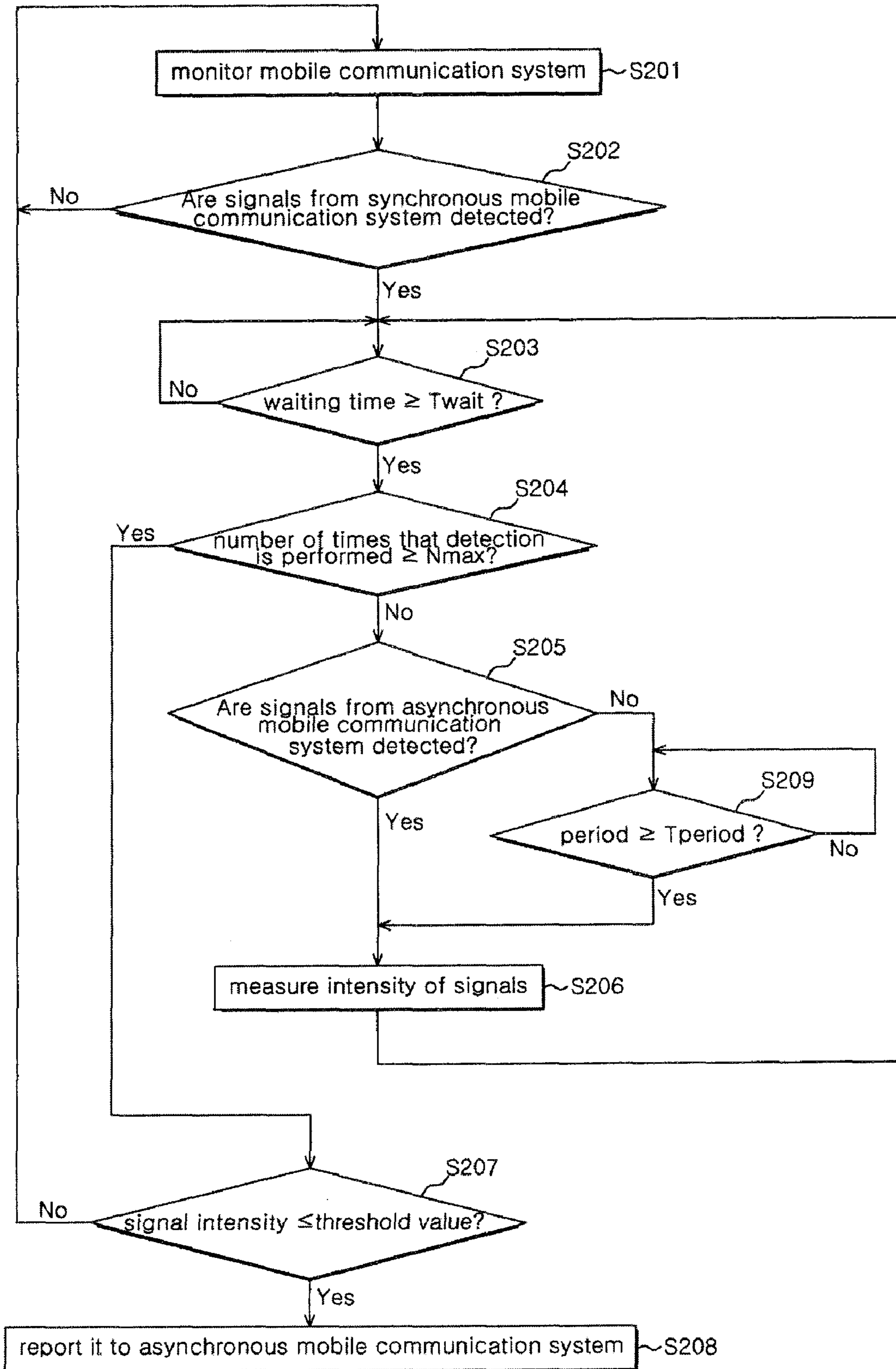


FIG.3



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**METHOD OF HAND-OVER IN THE MIXED
NETWORK OF ASYNCHRONOUS
COMMUNICATION NETWORK AND
SYNCHRONOUS COMMUNICATION
NETWORK**

CROSS REFERENCE TO RELATED
APPLICATION

This application is the National Phase application of Inter-
national Application No. PCT/KR2005/000022, filed Jan. 5,
2005, which designates the United States and was published
in English. This application, in its entirety, is incorporated
herein by reference.

TECHNICAL FIELD

The present invention relates generally to a handover
method in a mobile communication network and, more par-
ticularly, to a method capable of increasing the success rate of
handover of a mobile communication terminal in a mobile
communication network in which an asynchronous network
and a synchronous network coexist.

BACKGROUND ART

With the development of mobile communication technol-
ogy and the evolution of communication networks, various
types of mobile communication systems have been devel-
oped. In order to resolve the problem of global roaming
between the mobile communication systems, International
Mobile Telecommunications (IMT)-2000 systems have been
developed. The IMT-2000 systems are divided into a CDMA
2000-based synchronous system and a WCDMA-based asyn-
chronous system.

Furthermore, in order to support global roaming between
mobile communication systems, Dual Band Dual Mode
(DBDM) mobile communication terminals usable both in a
synchronous system and in an asynchronous system have
been developed. Using such a mobile communication termi-
nal, it is possible to use different types of services both in the
area of an asynchronous system and the area of a synchronous
system.

Currently, an asynchronous mobile communication system
is being constructed in areas in which high demand for service
exists and, therefore, a synchronous mobile communication
system is being evolved into a form in which the service area
thereof includes the service areas of the asynchronous mobile
communication system. When a user moves between the
asynchronous mobile communication system and the syn-
chronous mobile communication system, handover between
the systems is required in order to provide continuous service.

Particularly, when the mobile communication terminal is
located on the border between an asynchronous area and a
synchronous area, or a shadow area in the communication,
such as underground, precise handover for the mobile com-
munication terminal must be performed.

FIG. 1 is a conceptual diagram illustrating handover in a
mobile communication network in which an asynchronous
network and a synchronous network coexist.

As illustrated, in the case in which a mobile communica-
tion terminal 10 which is using service in an asynchronous
area A moves into the overlap area of the asynchronous area
A and a synchronous area B (through the movement path C of
the terminal), there are problems in that the intensity of sig-
nals between the asynchronous area A and the mobile com-
munication terminal 10 is similar to that of signals between

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the synchronous area B and the mobile communication ter-
minal 10, and variation in electric field strength is consider-
able, so that handover is not precisely performed and it takes
a long time to perform the handover.

DISCLOSURE OF THE INVENTION

Accordingly, the present invention has been made keeping
in mind the above problems occurring in the prior art and an
object of the present invention is to provide a handover
method capable of increasing the success rate of handover by
performing handover when the intensity of signals between a
mobile communication terminal and one mobile communi-
cation system, which currently provides service, is measured
a designated number of times and it is subsequently deter-
mined that the mobile communication terminal has moved
into the area of another mobile communication system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a conceptual diagram illustrating handover in a
mobile communication network in which an asynchronous
network and a synchronous network coexist;

FIG. 2 is a flowchart illustrating a general handover
method; and

FIG. 3 is a flowchart illustrating a handover method
according to the present invention.

BEST MODE FOR CARRYING OUT THE
INVENTION

In the present invention, as a mobile communication ter-
minal, which is using service in the area of an asynchronous
mobile communication system, detects signals from a syn-
chronous mobile communication system, the mobile commu-
nication terminal repeatedly performs a process of examining
whether, in a predetermined time, signals from the asynchro-
nous mobile communication system have been detected a
designated number of times, and measuring the intensity of
the signals. When the number of times that the intensity of the
signals from the asynchronous mobile communication sys-
tem is smaller than a designated number of times, or no
signals from the asynchronous mobile communication sys-
tem are detected, within the predetermined time, it is deter-
mined whether to perform handover of the mobile communi-
cation terminal.

A mobile communication terminal applied to the present
invention is a DBDM mobile communication terminal, and
can provide both asynchronous mobile communication ser-
vice and synchronous mobile communication service. The
DBDM mobile communication terminal can wirelessly
access each of an asynchronous mobile communication sys-
tem, and a synchronous mobile communication system and
use voice and data services. Furthermore, the DBDM mobile
communication terminal is connected between the asynchro-
nous mobile communication system and the synchronous
mobile communication system, and transmits and processes
signal processing states between the two systems.

In one mobile communication system, handover (or hand-
off) refers to the technology of allowing a user to perform
communication without the disconnection of a call when a
mobile communication terminal moves from one cell to
another cell.

The present invention provides a handover method for a
DBDM mobile communication terminal in a network in
which an asynchronous mobile communication system and a
synchronous mobile communication system coexist. The fol-

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lowing description is given for the case in which a mobile communication terminal moves from an asynchronous mobile communication system into a synchronous mobile communication system, rather than the case in which the mobile communication terminal moves from the synchronous mobile communication system into the asynchronous mobile communication system.

A preferred embodiment of the present invention is described below in detail with reference to the accompanying drawings.

FIG. 2 is a flowchart illustrating a general handover method.

A mobile communication terminal continuously monitors synchronous channels and common pilot channels not only for the base station of an area in which the mobile communication terminal is currently located but also for neighboring base stations, and measures the intensities of the signals. When the mobile communication terminal, which is using service in the area of an asynchronous mobile communication system, moves into the area of a synchronous mobile communication system, the intensity of signals from the asynchronous mobile communication system becomes weak. When the measured intensity of signals from the asynchronous mobile communication system is lower than a predetermined value at steps S101 and S102, the mobile communication terminal reports this to the asynchronous mobile communication system at step S103.

The asynchronous mobile communication system, having received this report, becomes aware that the mobile communication terminal is currently located on the border between the area of the asynchronous mobile communication system and the area of the synchronous mobile communication system, determines that handover to the synchronous mobile communication system is required, informs the mobile communication terminal of information about the base stations of a neighboring synchronous mobile communication system, and directs the mobile communication terminal to measure and report the intensity of signals from the synchronous mobile communication system.

As a result, the mobile communication terminal measures the intensity of signals from the synchronous mobile communication system at step S105, and reports the measured intensity to the asynchronous mobile communication system at step S106. The asynchronous mobile communication system requests handover to the synchronous mobile communication system by informing the synchronous mobile communication system of the report of the mobile communication terminal. Thereafter, the handover is performed according to a predetermined procedure at step S107.

In the handover method, when variation in the electric field strength of a wireless communication section is considerable, like the case where the mobile communication terminal is located on the border between the area of the asynchronous mobile communication system and the area of the synchronous mobile communication system, it is impossible to perform precise handover. For example, when the mobile communication terminal, which has moved from the area of an asynchronous mobile communication system into the overlap area between the areas of the asynchronous and synchronous mobile communication systems, and then moves from the overlap area into the area of the synchronous mobile communication system, handover from the asynchronous mobile communication system to the synchronous mobile communication system is performed.

However, when the mobile communication terminal immediately moves back to the overlap area, and the intensity of signals from the asynchronous mobile communication sys-

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tem is greater than that of signals from the synchronous mobile communication system in the overlap area where the mobile communication terminal is ultimately located, the quality of a call decreases or the call is disconnected, so that handover must be performed again.

Therefore, handover must be performed when the intensity of signals from a different mobile communication system is stable upon movement of a mobile communication terminal.

For this purpose, in the present invention, as a mobile communication terminal, which is using services in an asynchronous mobile communication system, detects signals from a synchronous mobile communication system, it repeatedly performs a process of examining whether, in a predetermined time, signals from the asynchronous mobile communication system have been detected a designated number of times, and measuring the intensity of the signals. Handover is performed when the measured signal intensity is lower than a predetermined threshold value.

FIG. 3 is a flowchart illustrating a handover method according to the present invention.

A mobile communication terminal, which is using service in an asynchronous mobile communication system, continuously monitors the synchronous channels and common pilot channels not only for the base station of an area in which the mobile communication terminal is currently located, but also for neighboring base stations at step S201.

In this case, when signals from the synchronous mobile communication system are detected at step S202, the mobile communication terminal waits for a predetermined Time. T_{wait} at step S203. The number of times that the intensity of signals detected from the asynchronous mobile communication system has reached a designated number of times, N_{max} , is then examined at step S204. If, as a result of the examination, the number of times that the intensity of signals from the asynchronous mobile communication system is determined to be below the designated number of times N_{max} , whether or not signals from the asynchronous mobile communication system are detected is examined at step S205. The intensity of the signals is measured when the signals are detected at step S208. Steps S203, S204 and S205 are repeatedly performed a designated number of times N_{max} , while the number of times that signals from the asynchronous mobile communication system are detected is increased.

After examining whether a predetermined time T_{wait} has elapsed and examining whether signals from the asynchronous mobile communication system have been detected a designated number of times N_{max} , it is determined whether the intensity of the last signals from the asynchronous mobile communication system is larger than a predetermined threshold value at step S207. If the intensity is larger than the predetermined threshold value, the process returns to step S201 of monitoring the asynchronous mobile communication system and the synchronous mobile communication system.

Meanwhile, when no signals from the asynchronous mobile communication system are detected at step S205, in which whether or not signals from an asynchronous mobile communication system are detected is examined, a designated time, T_{period} , elapses at step S209 and the process then proceeds to step S206 of measuring the intensity of signals from the asynchronous mobile communication system.

In this case, it is preferable that information about a waiting time T_{wait} for the detection of signals from an asynchronous mobile communication system, the number of times N_{max} that detection is performed, and a waiting time T_{period} in the case where no signals from an asynchronous mobile communication system are detected are transmitted using the System Information Block (SIB) of the asynchronous mobile com-

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munication system. The waiting time T_{wait} may be set to, for example, 30 to 90 seconds, the number of times N_{max} that detection is performed may be set to, for example, 8 to 12, and the waiting time T_{period} in the case where no signals from the asynchronous mobile communication system are detected may be set to, for example, 4 to 6 minutes.

Furthermore, when the measured intensity of signals from the asynchronous mobile communication system is below the predetermined threshold value at step S207, the mobile communication terminal reports this to the asynchronous mobile communication system at step S208.

The asynchronous mobile communication system determines that the mobile communication terminal requires handover to the synchronous mobile communication system based on the report from the mobile communication terminal, and causes a handover procedure to be performed between the asynchronous mobile communication system, the mobile communication terminal, and the synchronous mobile communication system.

For the performance of the handover, the mobile communication terminal transmits information about the pilot channel of the synchronous mobile communication system to the asynchronous mobile communication system, thereby allowing the asynchronous mobile communication system to easily direct the handover. Particularly, in the present invention, when transmitting information about the pilot channel of the synchronous mobile communication system to the asynchronous mobile communication system, the mobile communication terminal assigns a specific value (for example, '0') to a scrambling code which is a field defined by the asynchronous mobile communication system, so that there are advantages in that the base station of the asynchronous mobile communication system can easily become aware of the radio environment of the synchronous mobile communication system, and a search for the base station of the synchronous mobile communication system can be performed using signals from the asynchronous mobile communication system.

Since a detailed handover procedure is performed according to a procedure designated by the operator of a mobile communication system, a detailed description thereof is omitted. It is preferable to employ a method capable of more rapidly performing a handover without the occurrence of call disconnection during the handover.

Those skilled in the art can understand that the present invention can be implemented in specific forms without alteration of the technical spirit and essential characteristics of the invention. As a result, it is to be understood that the above-described embodiment is illustrative in all respects, and not restrictive. The scope of the present invention is defined by the accompanying claims rather than the detailed description, and modifications and variations, which are derived from the spirit and scope of the claims and equivalents thereto, are included in the scope of the present invention.

INDUSTRIAL APPLICABILITY

According to the above-described present invention, in a mobile communication network in which an asynchronous mobile communication system and a synchronous mobile communication system coexist, the mobile communication terminal detects signals from the synchronous mobile communication system, examines whether signals from the asynchronous mobile communication system have been detected a designated number of times, and allows handover to be performed when the intensity of signals from the asynchronous mobile communication system is lower than a predeter-

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mined threshold value, so there is an advantage in that the handover is precisely performed.

The invention claimed is:

1. A handover method of a Dual Band Dual Mode (DBDM) mobile communication terminal in a mobile communication network in which an asynchronous mobile communication system and a synchronous mobile communication system coexist, comprising the sequential steps of:

the mobile communication terminal in service with the asynchronous mobile communication system detecting signals from a synchronous mobile communication system;

if signals from a synchronous mobile communications system are detected, repeatedly performing a process of:

examining whether a predetermined time T_{wait} has elapsed,

examining whether the signals from the asynchronous mobile communication system have been detected a designated number of times N_{max} , and measuring the intensity of the signals from the asynchronous mobile communication system; and

handing over the mobile communications terminal from the asynchronous mobile communication system to the synchronous mobile communication system when the measured signal intensity from the asynchronous mobile communications system is lower than a predetermined threshold value.

2. The handover method as set forth in claim 1, further comprising:

transmitting, in a System Information Block (SIB) defined by the asynchronous mobile communication system, information about the waiting time T_{wait} for the detection of signals from an asynchronous mobile communication system, the number of times N_{max} that detection is performed, and a waiting time T_{period} in a case where no signals from the asynchronous mobile communication system are detected.

3. The handover method as set forth in claim 1, wherein the step of examining whether signals from the asynchronous mobile communication system are detected comprises the steps of:

examining whether a designated waiting time T_{period} has elapsed when no signals from the asynchronous mobile communication system are detected; and

measuring the intensity of signals from the asynchronous mobile communication system when the designated time T_{period} has lapsed.

4. The handover method as set forth in claim 3, wherein information about the waiting time T_{period} is transmitted to the mobile communication terminal by the asynchronous mobile communication system through a System Information Block (SIB).

5. The handover method as set forth in claim 1, wherein the step of reporting the intensity of the signals to the asynchronous mobile communication system comprises the step of the mobile communication terminal transmitting information about a pilot channel of the synchronous mobile communication system to the asynchronous mobile communication system.

6. The handover method as set forth in claim 5, further comprising:

transmitting a code, representing a radio environment between the mobile communication terminal and the synchronous mobile communication system in a specific field of a message, the message representing the information about a pilot channel of the synchronous mobile communication system.